Dose Calibration of the ISS-RAD Fast Neutron Detector

C. Zeitlin on behalf of the ISS-RAD Science Team

The ISS-RAD instrument has been fabricated by Southwest Research Institute and delivered to NASA for flight to the ISS in late 2015 or early 2016. ISS-RAD is essentially two instruments that share a common interface to ISS. The two instruments are the Charged Particle Detector (CPD), which is very similar to the MSL-RAD detector on Mars, and the Fast Neutron Detector (FND), which is a boron-loaded plastic scintillator with readout optimized for the 0.5 to 10 MeV energy range. As the FND is completely new, it has been necessary to develop methodology to allow it to be used to measure the neutron dose and dose equivalent. This talk will focus on the methods developed and their implementation using calibration data obtained in quasi-monoenergetic (QMN) neutron fields at the PTB facility in Braunschweig, Germany. The QMN data allow us to determine an approximate response function, from which we estimate dose and dose equivalent contributions per detected neutron as a function of the pulse height. We refer to these as the "pSv per count" curves for dose equivalent and the "pGy per count" curves for dose. The FND is required to provide a dose equivalent measurement with an accuracy of ±10% of the known value in a calibrated AmBe field. Four variants of the analysis method were developed, corresponding to two different approximations of the pSv per count curve, and two different implementations, one for real-time analysis onboard ISS and one for ground analysis. We will show that the preferred method, when applied in either real-time or ground analysis, yields good accuracy for the AmBe field. We find that the real-time algorithm is more susceptible to chance-coincidence background than is the algorithm used in ground analysis, so that the best estimates will come from the latter.